Nanomaterials Research at the Molecular Foundry

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Community Advisory Group
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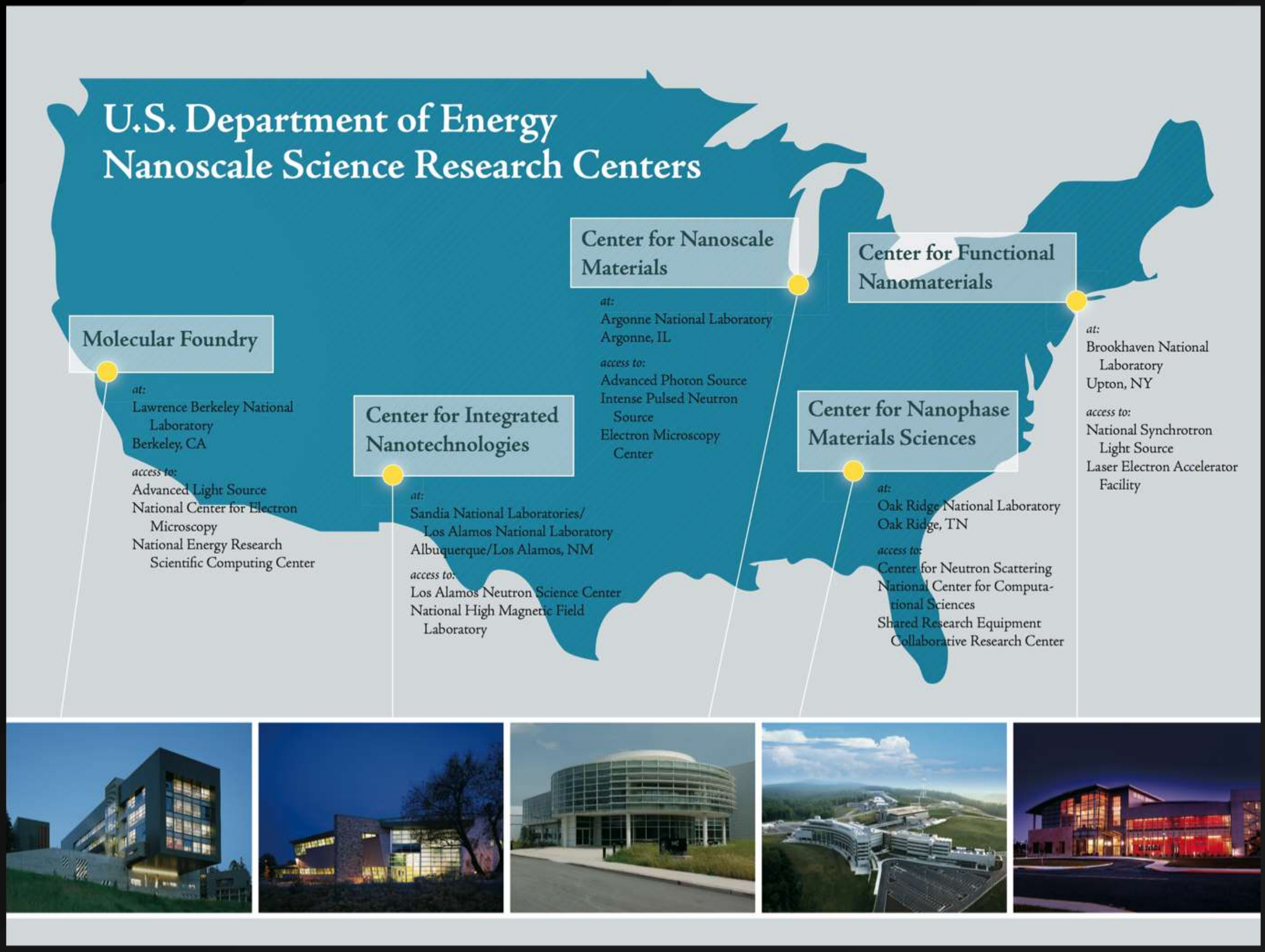
Working at the Molecular Foundry



Working at the Molecular Foundry

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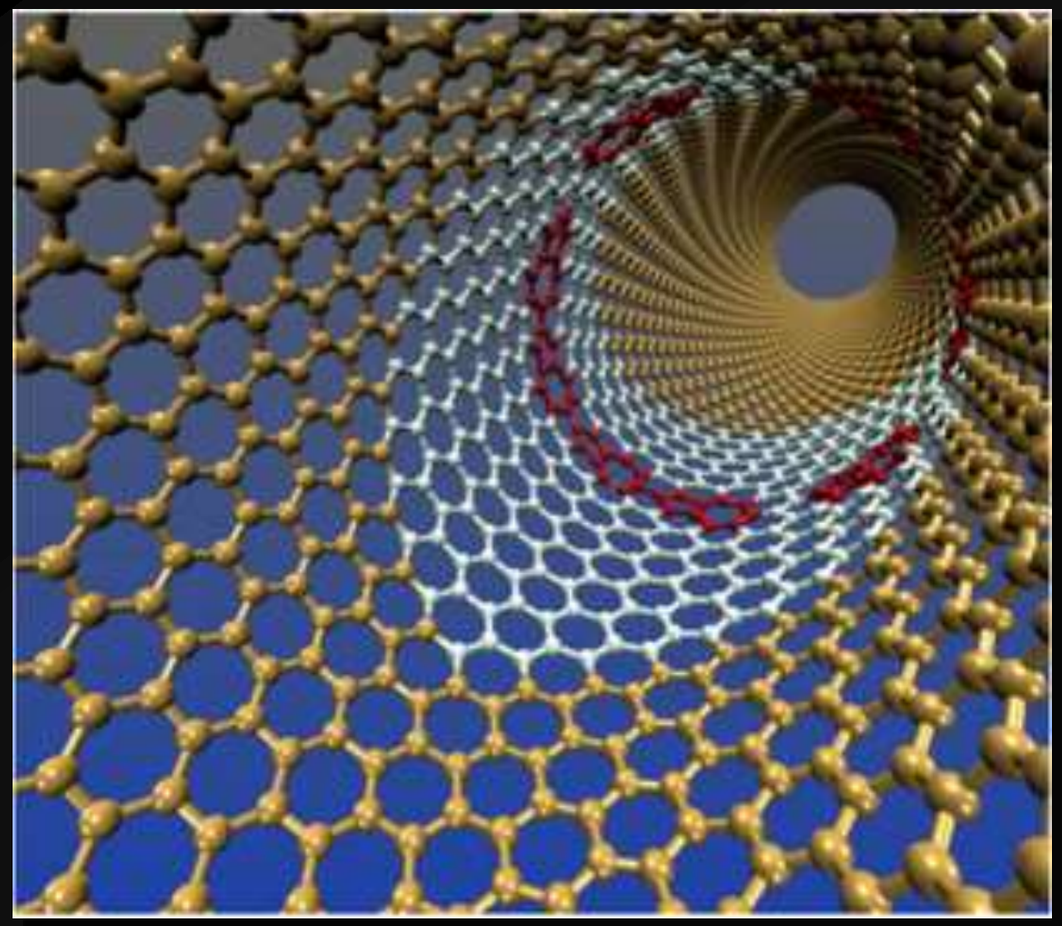
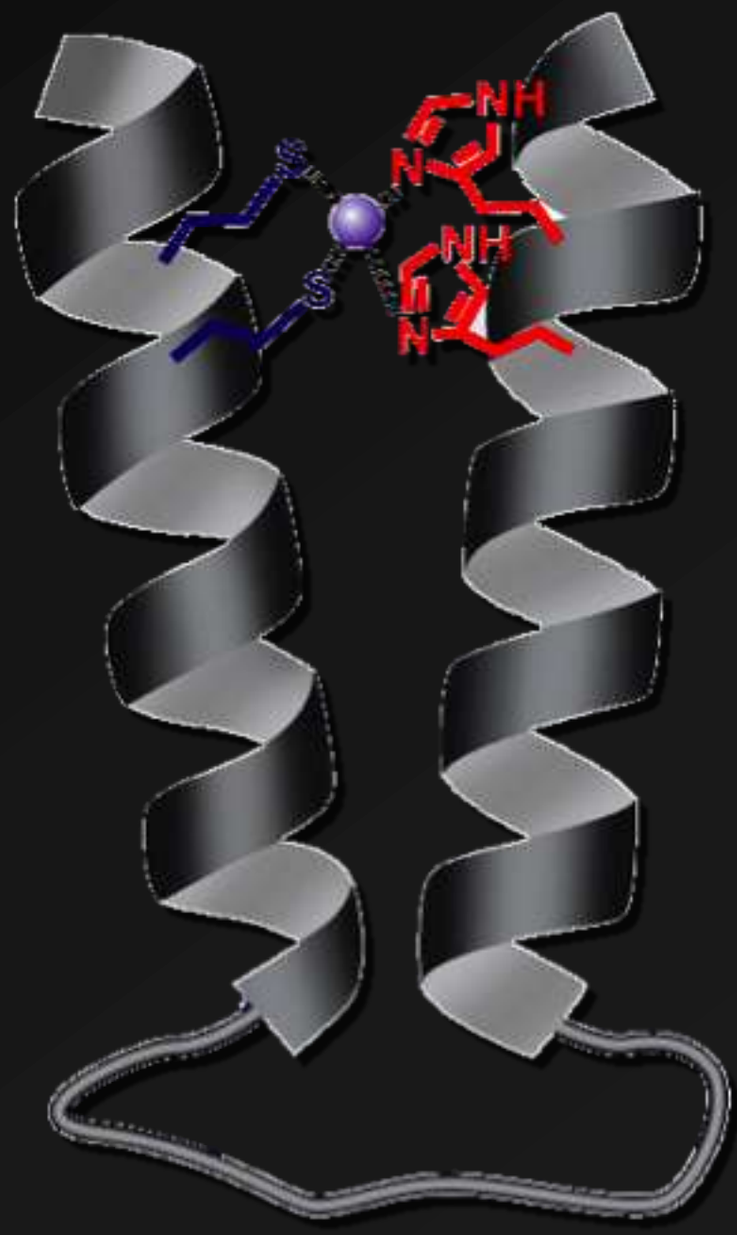
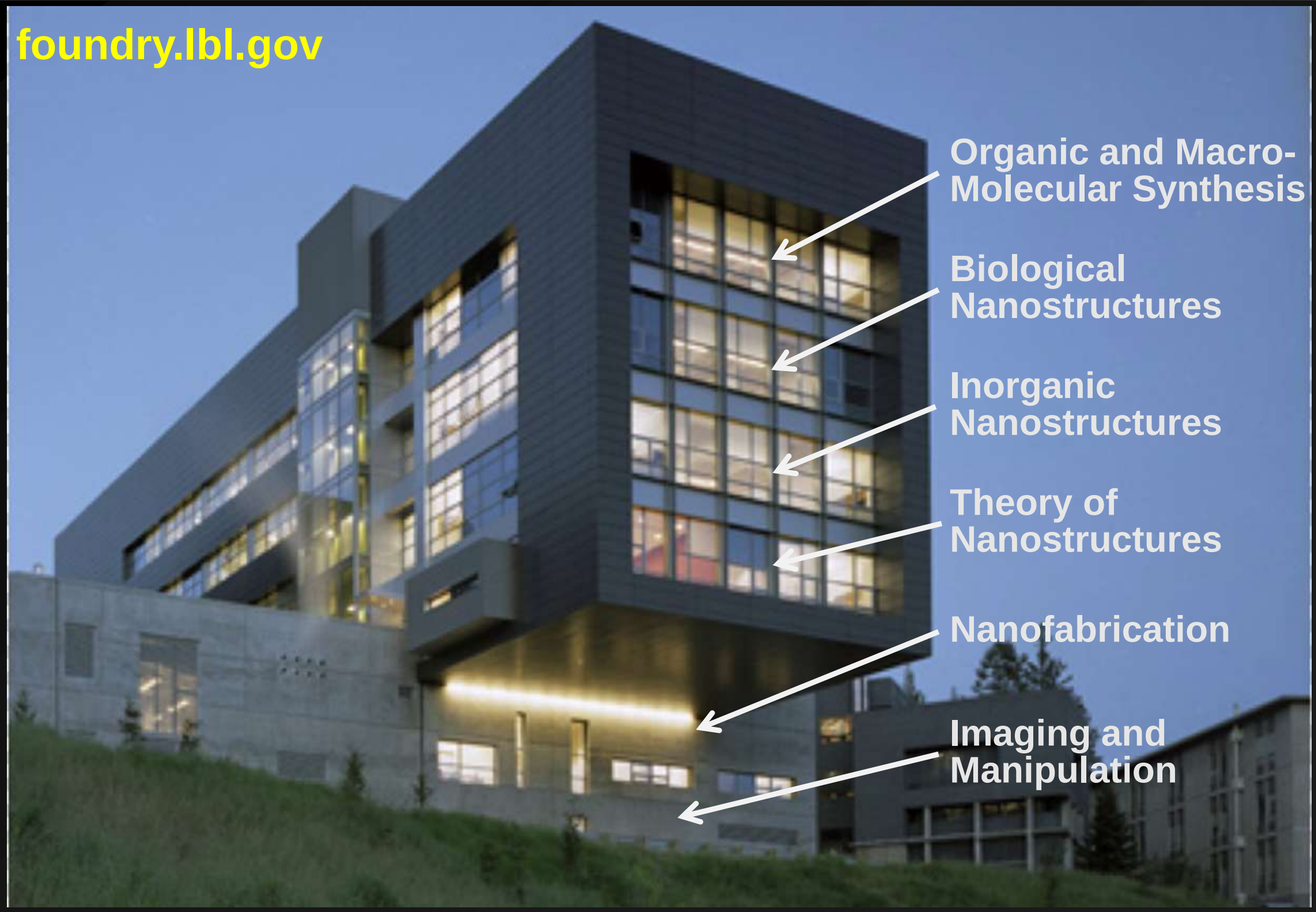
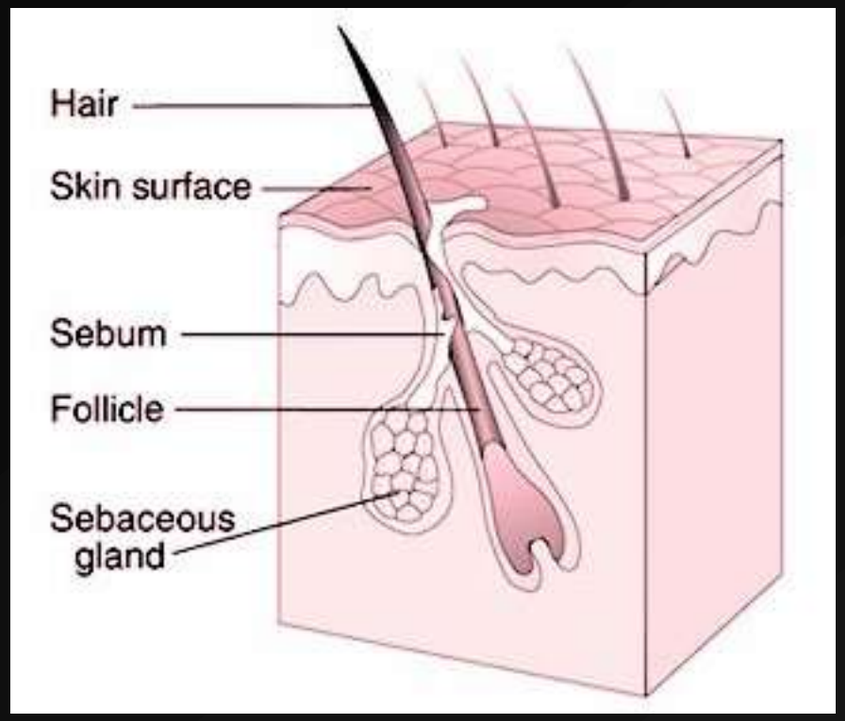


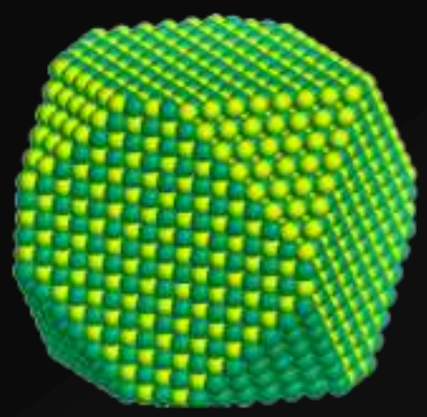


The Molecular Foundry is a multi-disciplinary user facility for nanoscience



x 20,000





5 nm
5000 atoms

x one million

MOLECULAR FOUNDRY

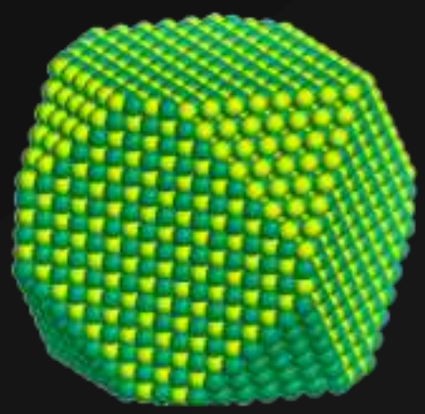
Gold

Nano Gold

Size-dependent light emission from semiconductor nanocrystals (quantum dots)

size

1.7 nm
600 atoms



6 nm
6000 atoms

Couch >> puppy
Low energy state

Puppy >> couch
High energy state

increasing confinement

Thanks to: B. Cohen, J. Urban

Making nanocrystals by using robots to do chemistry

Using robots to do chemistry (video)

http://www.youtube.com/watch?v=I22En9JOj3A

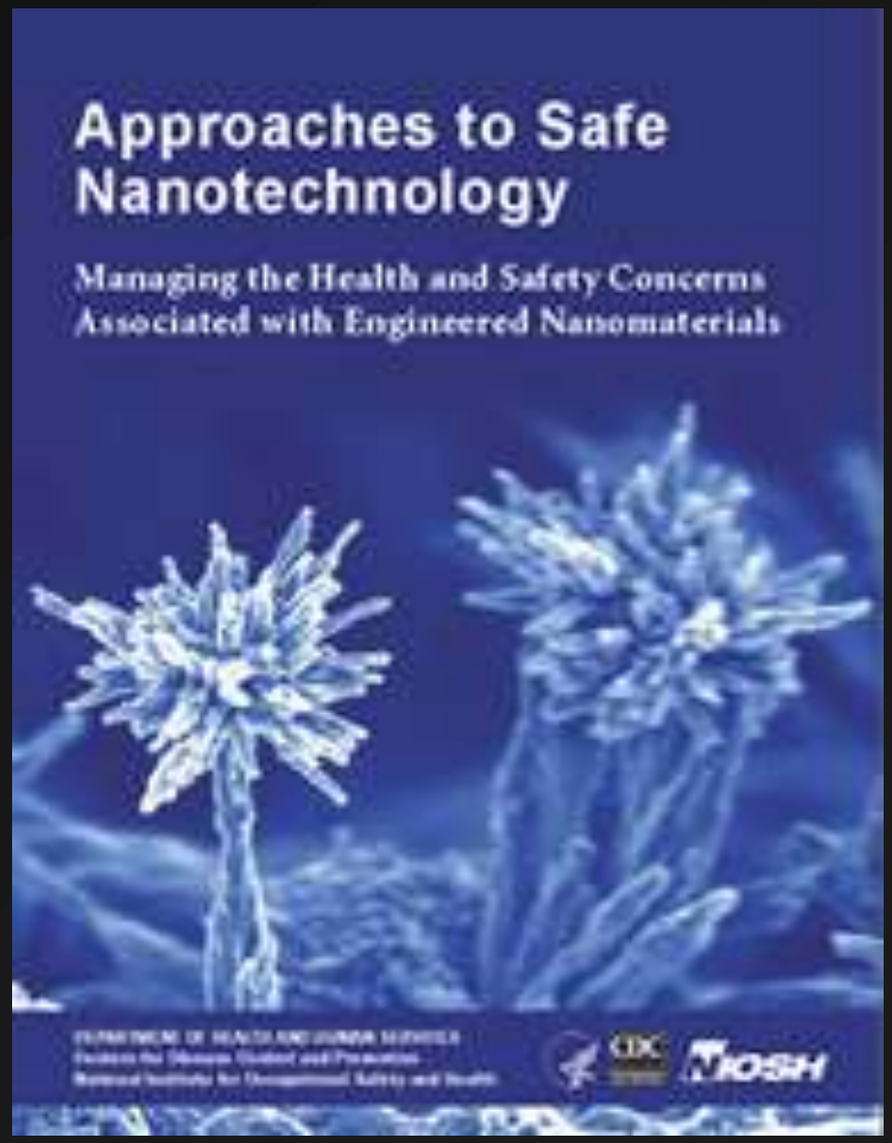
Integrating safety into science

What is different about a nanomaterial from its bigger form?

What happens to nanomaterials in the environment?

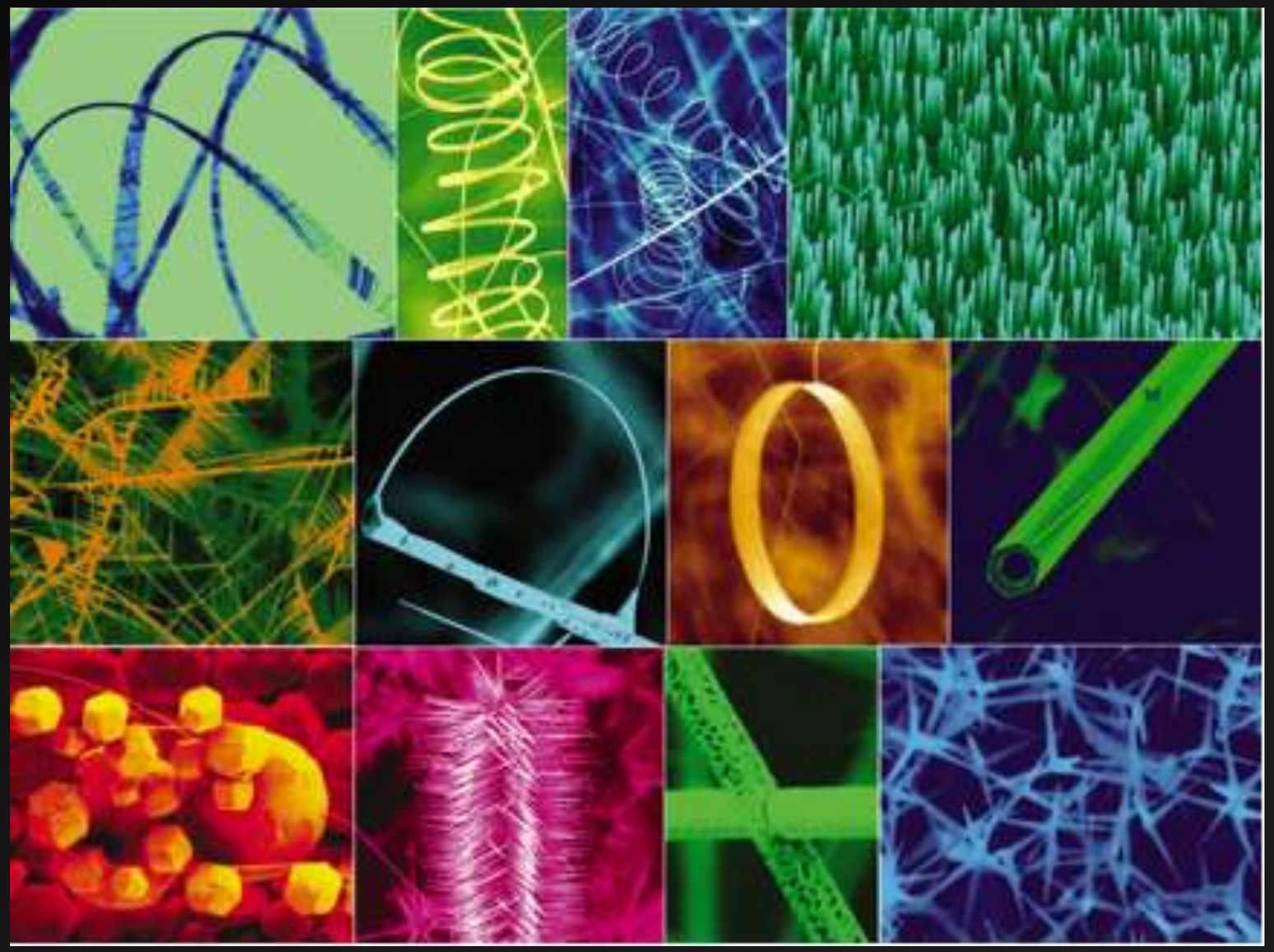
Are there safety issues for workers involved in making or researching nanomaterials?

Do we have the right tools to manage these materials properly?



One chemistry, many forms

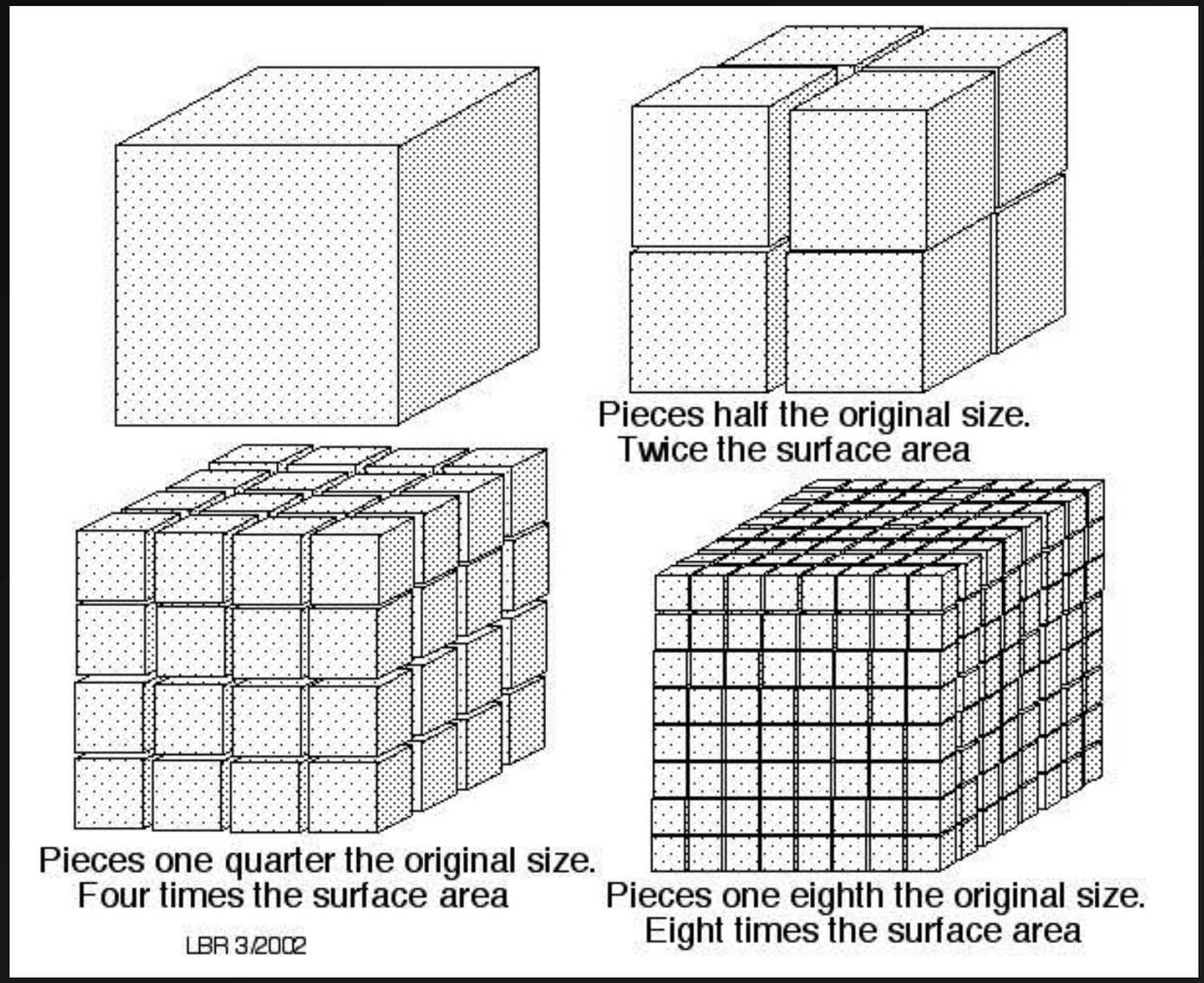
- Size
- Shape
- Chemistry
- Crystal structure
- Water solubility
- Surface area
- Surface coating
- Agglomeration state
- Density
- Dispersibility
- Porosity
- Surface charge
- Conductivity
- Contaminants
- Manufacturing method



One material: ZnO

New properties, different issues

Size
Shape
Chemistry
Crystal structure
Water solubility
Surface area
Surface coating
Agglomeration state
Density
Dispersibility
Porosity
Surface charge
Conductivity
Contaminants
Manufacturing method

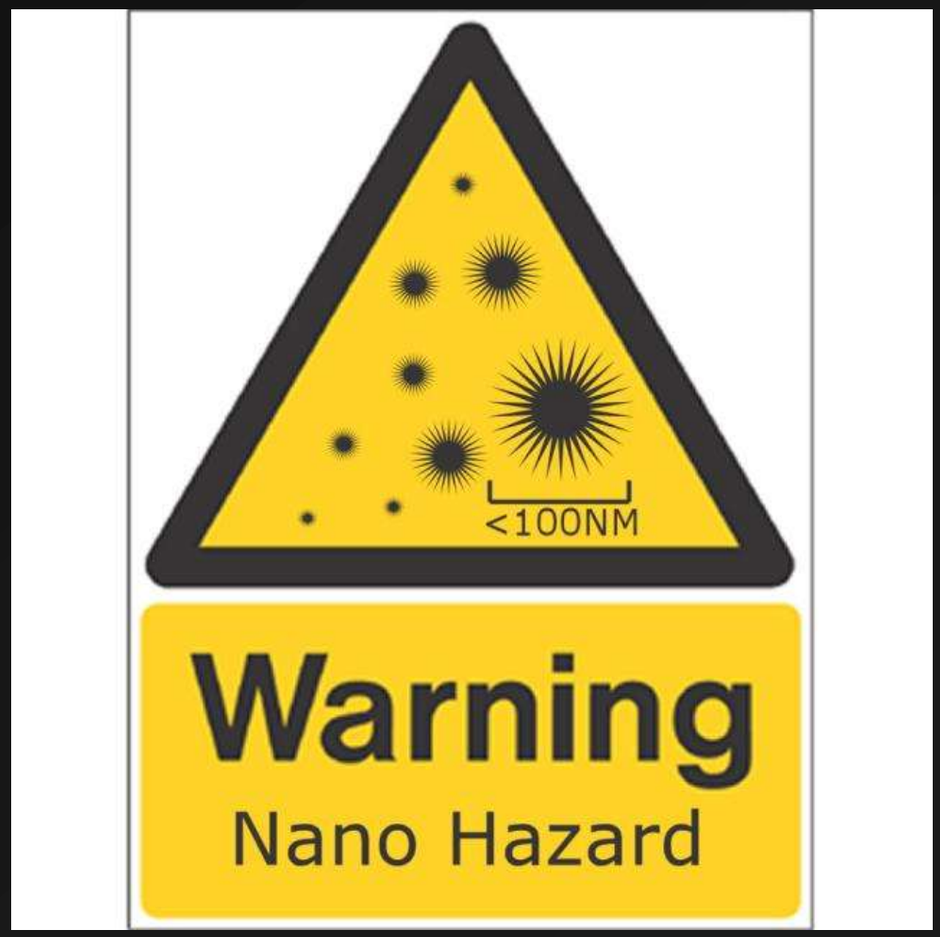


More surface area
= more reactivity

DOE policy on nanotechnology

DOE Order 456.1

- Constantly monitor the toxicological literature and safety guidance documents for new developments
- Keep a record of researchers potentially exposed
- Establish engineered nanoparticles safety policy and provide training
- Minimize researcher exposure to engineered nanoparticles
- Post warning signs, label containers of engineered nanoparticles
- Manage waste carefully

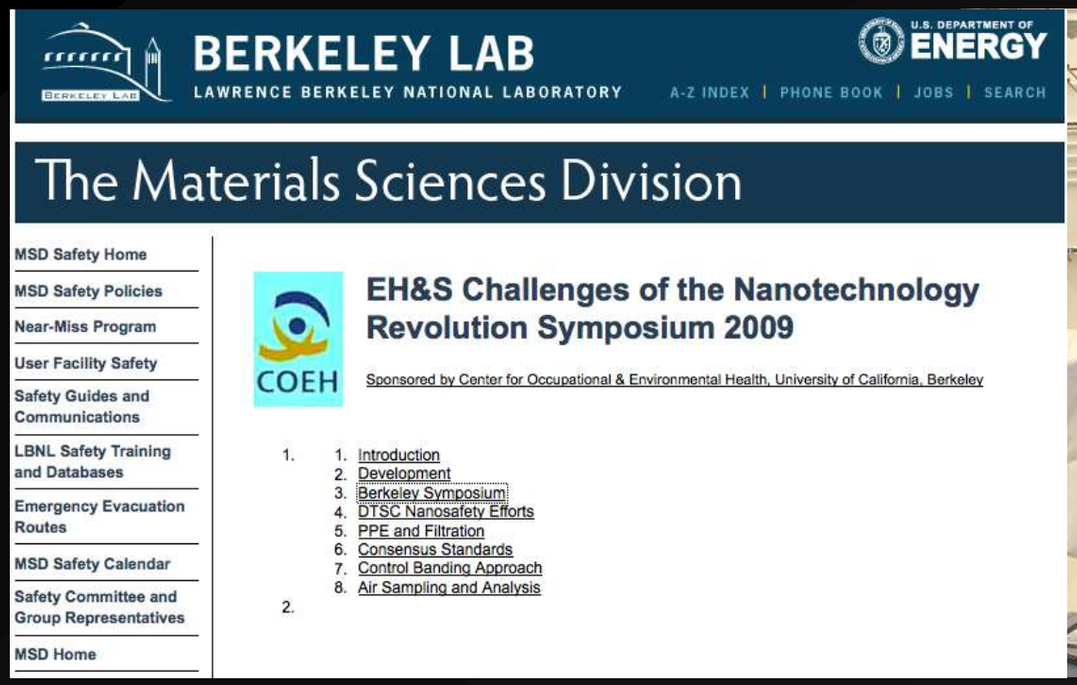


Foundry safety philosophy and approach

Fume hoods and glovebox environments

Special safety training for engineered nanoparticles

Proactive nanoparticle safety training and outreach efforts

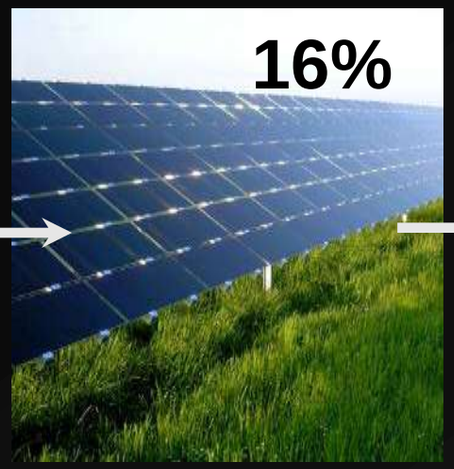


Sponsor symposia to train health and safety professionals, physicians, community members

Special detection techniques: zero-background nanoparticle aerosol measurement glovebox

Using sunlight effectively: Electric Conversion vs. Direct Use

100



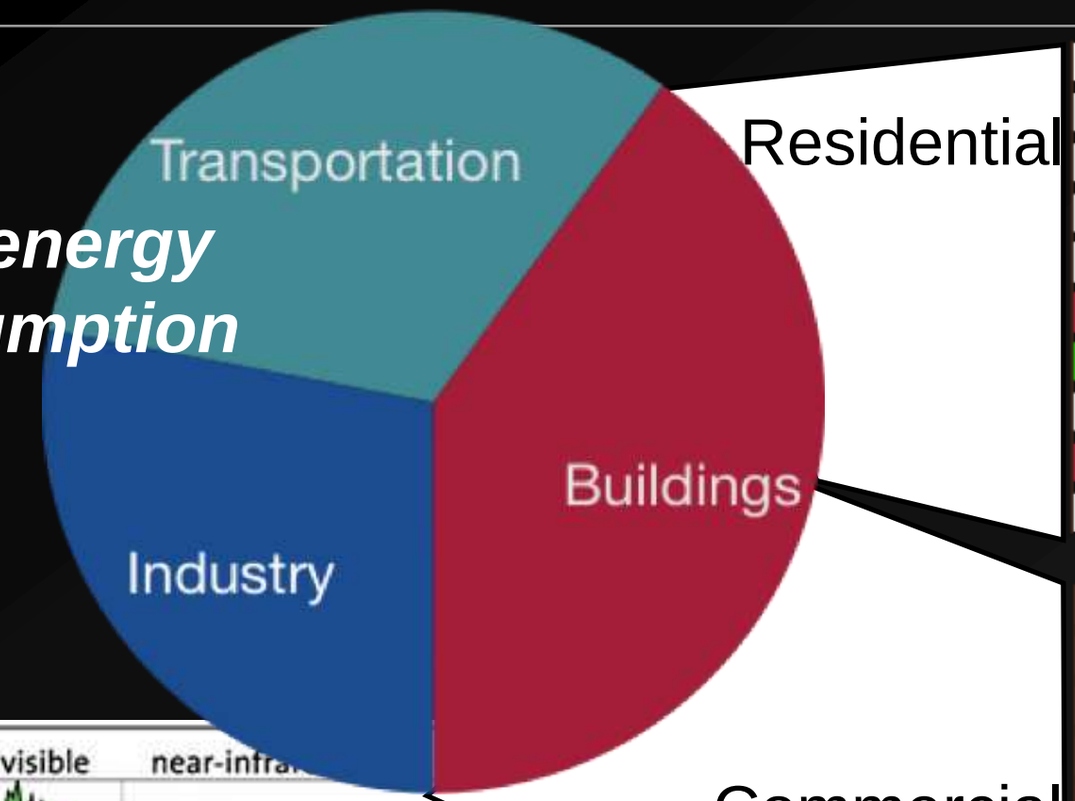
2

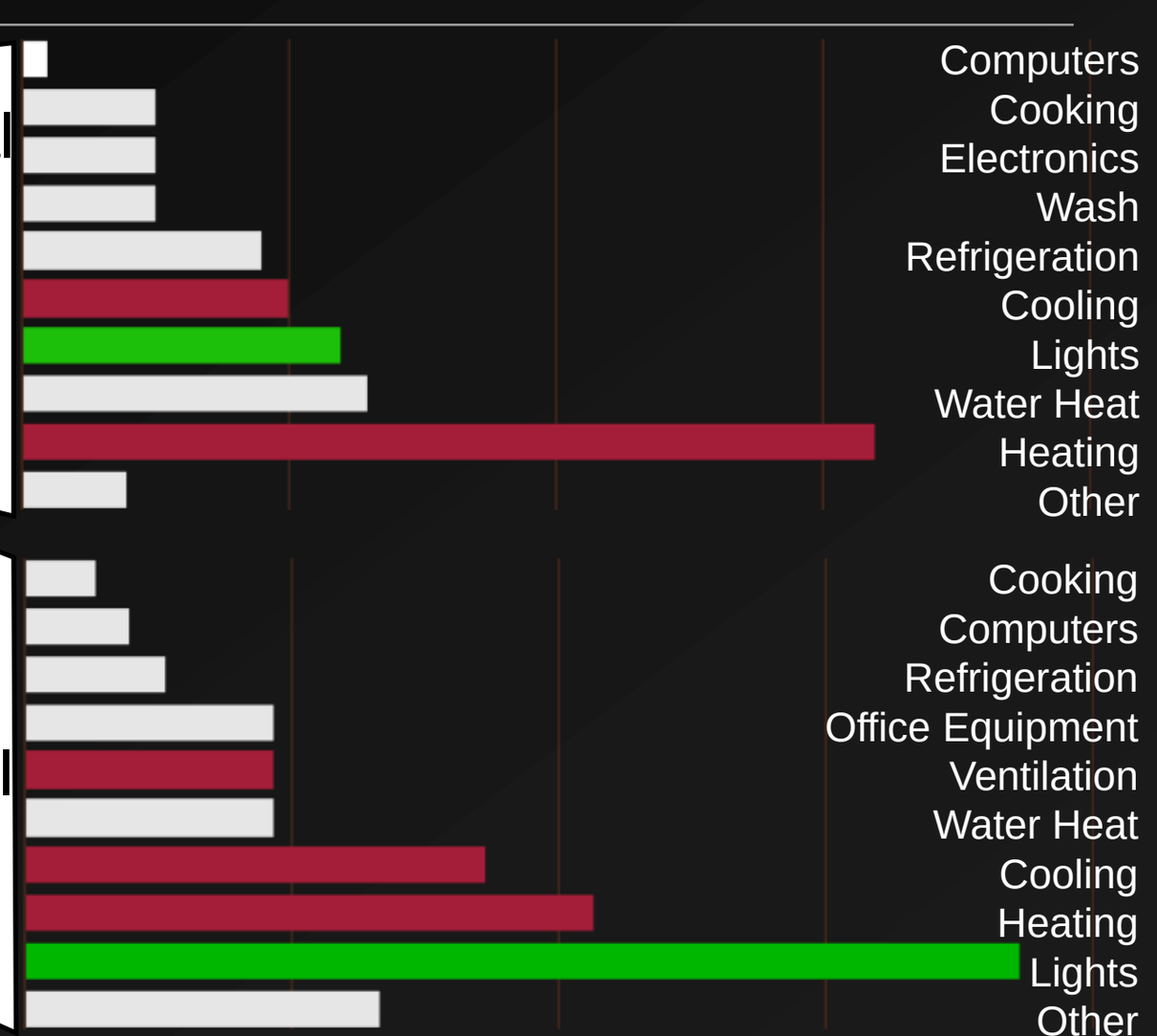
50%

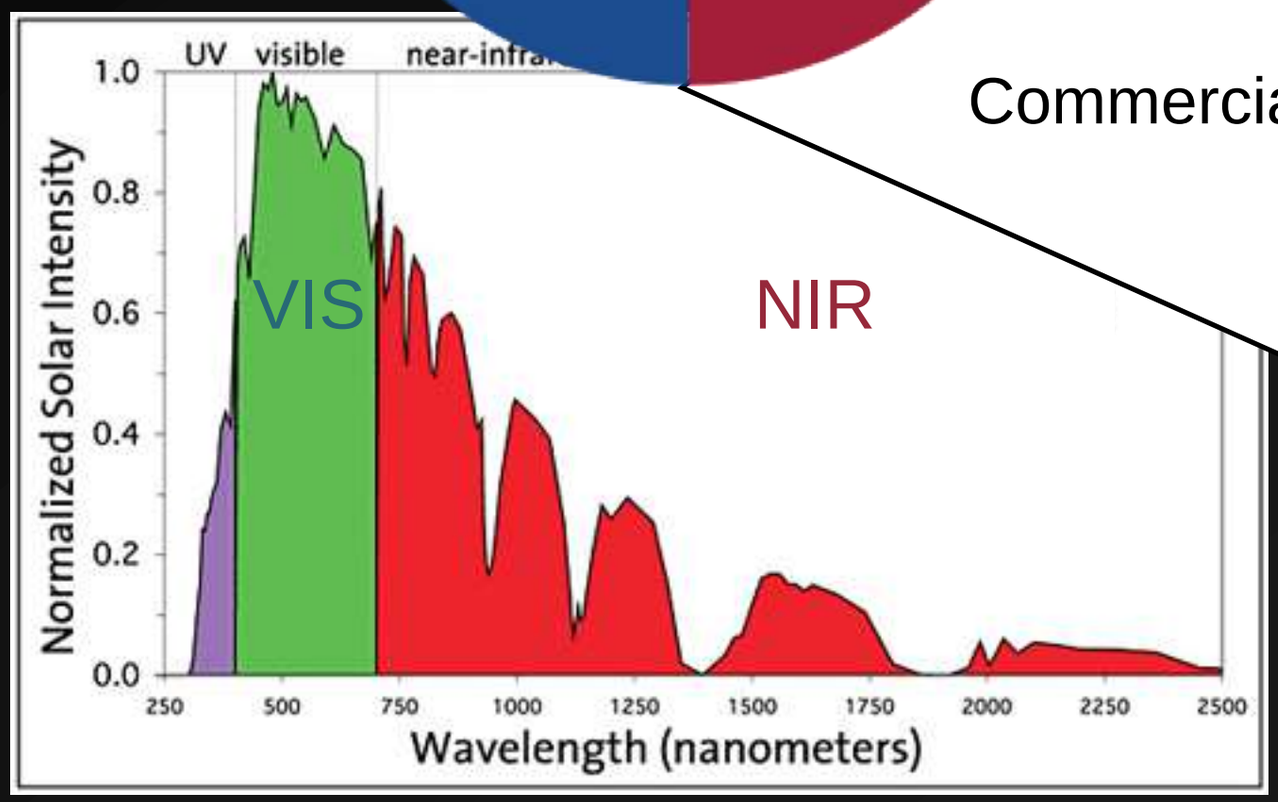
25

Motivation for dynamic infrared window coatings: Lighting and thermal management

U.S. energy consumption



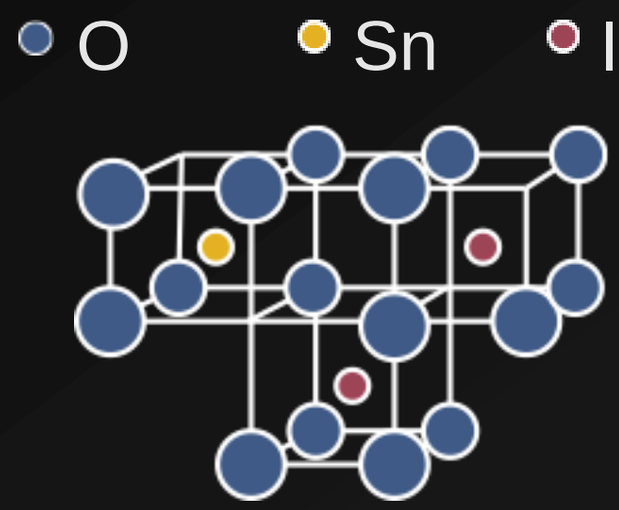


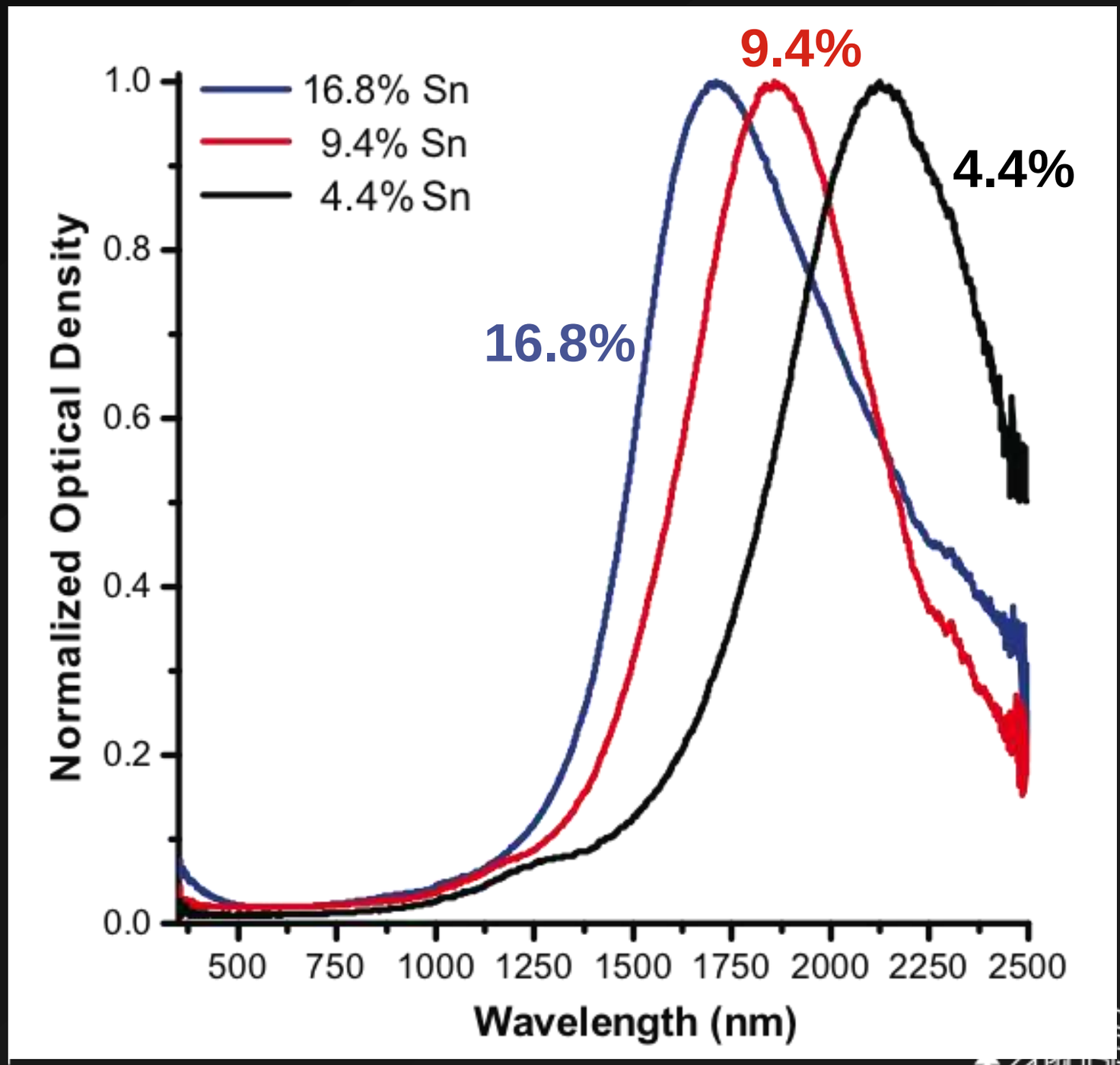


Solar Energy

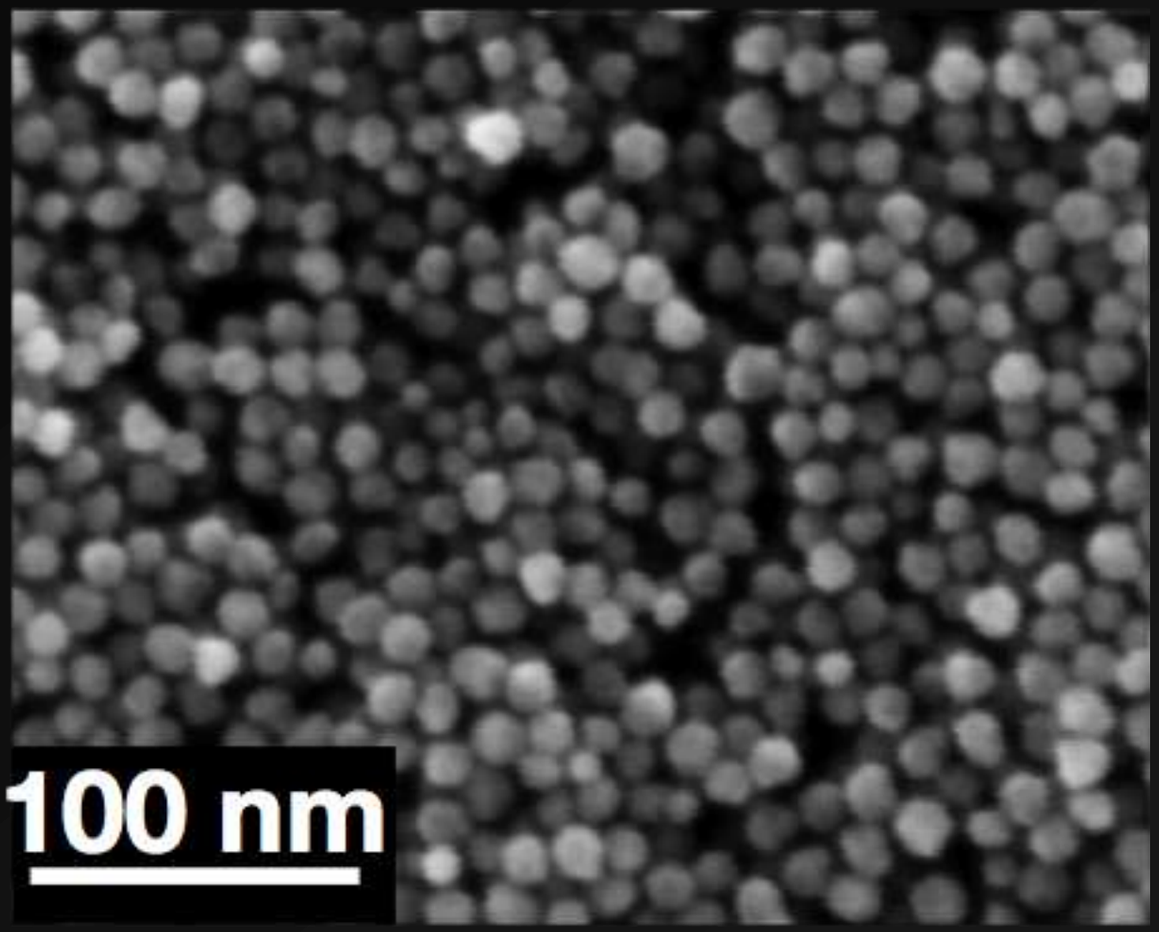
- **Visible: use for lighting**
- **NIR: use for heating**

Transparent nanocrystals that absorb infrared radiation from the sun

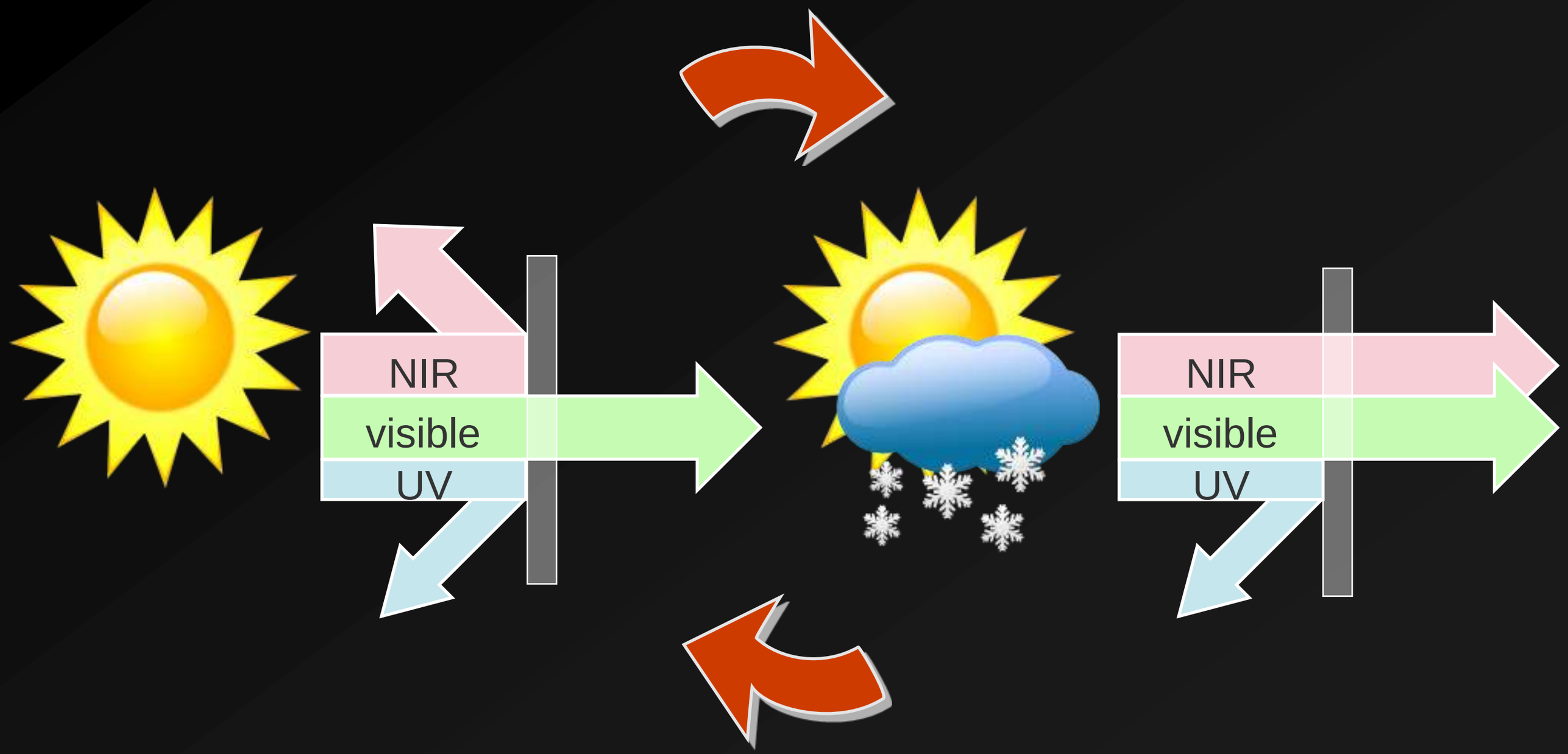




Nanocrystal window coating



A nanocrystal-powered smart window



Thank you!

foundry.lbl.gov